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Process reduces fabrication and assembly costs

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WRIGHT-PATTERSON AFB, Ohio – The Composites Affordability Initiative (CAI) team has demonstrated a process that will dramatically reduce the costs of composite fabrication and assembly. The CAI team consists of the Air Force Research Laboratory's Materials and Manufacturing and Air Vehicles Directorates, the Navy's Office of Naval Research, Boeing, Lockheed Martin, and Northrop Grumman.

The process they've come up with is called CoRTM (Co-curing of an uncured skin to a Resin Transfer Molded substructure). It was developed by Northrop Grumman, and produces large, integrated, weight-efficient, precise and repeatable structures.

A vertical stabilizer from the F-35 was used to demonstrate the technology. These results, using CoRTM in the manufacturing of the part, revealed that nearly $14,000 in savings could be derived through reduced tooling, part count, fastener count and the associated fit-up, liquid shimming and surface mold line treatments for air vehicles.

Traditional aircraft structures consist of multiple piece assemblies that are pre-fit together, gaps between mating surfaces are filled with shim materials to create a snug fit, and then mechanically fastened in place. This results in very lengthy manufacturing flow times and high acquisition costs.

Now, the CoRTM process has been proven to be a viable and promising alternative for affordable composite structures. CoRTM combines two cost effective processes: fiber placement (the automated placement of bands of high strength fibers combined with resin onto a tool) for skin structures, currently used on the F-35, F-18, V-22, F-22, etc.; and resin transfer molding (the injection of high strength resin into a mold containing high strength fibers formed to a specified shape) for substructures currently used on the F-22 Raptor and a growing list of other aircraft.

Instead of fastening the skin to the substructure, the CoRTM process enables the skin and the substructure to be designed and fabricated as a single component, eliminating the need to fasten them together. After the fiber placement process lays up the uncured skin, the substructure is built-up by placing and tooling dry fiber preforms on top of the uncured skins. The preforms are then injected with resin, and the whole assembly is then cured to form the structure.

The combination of these two processes results in highly accurate stiffened skin structures with no fasteners through the skin. This creates structures with fewer parts and minimal fasteners, resulting in reduced assembly costs.

This process has been demonstrated with epoxy and bismaleimide resins through the fabrication of small coupons up through the fabrication and testing of full-scale structures such as a wingbox and a vertical tail stiffened skin. An invention disclosure for the CoRTM technology has been submitted and is currently under review.

The dimensional precision and repeatability of the resin transfer molding process also enables the use of Z-reinforcement technologies such as Z-Pins and 3D preforms, increasing the potential applications by enhancing structural performance.

The savings, versus the baseline construction costs, for the F-35 tail represent a 52 percent reduction in part count, a 38 percent reduction in tool count, a seven percent reduction in weight and a 17 percent overall cost reduction when compared to the typical F-35 construction process.

For more information on CoRTM, or the CAI, call the Technology Information Center at (937) 255-4689. Refer to item number 02-068. **@**